REMARKS/ARGUMENTS

The Examiner had objected to claim 2. Claim 2 is being cancelled and the subject matter of claim 2 effectively incorporated into claim 1, so that the Examiner's objections are now moot. It is here noted that, in the method claims, correspondingly the subject matter of claim 11 is effectively being introduced into the main method claim, claim 10.

The Examiner had rejected all of the claims under 35 U.S.C. 102(b) as being anticipated by Meltser et al. Meltser et al. are, fundamentally, concerned with a different type of fuel cell monitoring system. This patent is concerned with monitoring a variety of characteristics, indicative of the performance of a stack of PEM fuel cells. As the summary of the invention section indicates, in the paragraph bridging columns 1 and 2, it is intended to automatically trigger corrective measures when the performance degrades to an unacceptable level "as for example, may occur incident to CO poisoning of the anode catalyst, water flooding of one or more the cells and/or excessive hydrogen invasion of the cathode gas". The invention of Meltser et al. specifically contemplates "(1) measuring (i) hydrogen concentration in the cathode exhaust gas, (ii) individual cell voltages, and (iii) overall stack voltage, and (2) comparing the measured values to predetermined reference values of acceptability to indicate the condition of a PEM fuel cell stack" (column 2, lines 6-11).

As Figure 2 indicates, a relatively complex scheme is proposed where various conditions are monitored, and in the sense of Boolean logic, combined together to determine whether a necessary alert needs to be generated. Thus, Figure 2 contemplates three different types of alerts, namely: a hydrogen bridging action 98; a hydrogen bridging alert 100; and a performance degradation alert 102. Note that the performance degradation alert 102 depends upon three factors being present, namely: (i) condition (1) that the corrected hydrogen concentration is less than constant C2; (ii) a condition (5) that the dV is indicative of a problem with the cells; and (iii) a condition (6), the rate of change of the stack voltage with respect to time being too high, indicative of a problem.

The paragraph at column 8, lines 7-37 details actions that the controller 40 can take, as provided by a number of subroutine programs, where these various combinations of conditions are detected. It notes, for example, that, if conditions 2, 3 and 6 coexist, the corrective measures can include: "alert the operator, or trigger a subroutine/program which automatically starts to correct the problem, e.g., by shutting down the stack, or throttling it back by opening/closing such valves, switches, etc. in the fuel cell system..." In response to conditions 4, 7 and 1 coexisting, the triggered subroutine, it is suggested, may "illuminate a warning light, sound an alarm or automatically undertake steps to reduce the effects of unacceptable hydrogen bridging". If conditions 1, 5 and 6 exist, this can trigger a subroutine which may "illuminate a warning light, sound an alarm or automatically undertake appropriate corrective action...For example in the case of carbon monoxide poisoning, a subroutine may be initiated which cuts off hydrogen flow when the stack is idle". It is further suggested, at the end of the paragraph, that "H_2O flooding, on the other hand, may be mitigated by flowing excess air through the cathode flow channel."

Despite the references to all sorts of other problems and faults in a fuel cell and various corrective actions, this is the only reference to any suggested action to deal with flooding. Nowhere is it mentioned how any of these schemes can be applied to a fuel cell with recirculation of reactants.

In contrast, the present invention squarely addresses the issue flooding in fuel cells. As defined in amended claims 1 and 10, the present invention provides a system and method in which a fuel cell variable is monitored to detect the presence of flooding. When detected, the controller controls both (1) the first reactant supply means, and (2) the second reactant supply means, to provide additional amounts of both of the first and second reactants to the fuel cell anode and cathode. This is intended to ensure that, irrespective of whether flooding is occurring in the anode or cathode, any such flooding, i.e. excess water, is displaced by the additional flow of the reactants provided. Meltser et al. merely, at most, hint or suggest some action to be taken with respect to flooding on the cathode side; there is no teaching, suggestion or recognition of any problem of flooding on the anode side.

Accordingly, it is submitted that the claims as submitted are clearly both novel and inventive with respect to the cited reference, and all other known art.

Summary of Claim Amendments

As mentioned, the subject matter of claim 2 has effectively been incorporated into claim 1. Additionally, in claim 1, it is now made clear that the fuel cell has a cathode for the first reactant and an anode for the second reactant. Consequential minor amendments have additionally been made to claim 1.

In claim 3, the fuel cell system is now stated to include a second reactant recirculation line. Meltser et al. are largely silent on the concept of recirculation, and certainly nowhere address the issue of purging when recirculation is present. Thus, Meltser et al. fail to realize that, in a recirculation system, to achieve effective clearance of a flooding situation, purging needs to be provided, in order that the excess moisture or fluid can be vented from the system. Thus, it is submitted that claim 3, and its counterpart method claim 12, are clearly both novel and inventive over the known art.

Some new fuel cell system claims 19-24 have been introduced, detailing: claim 19, the variant of the fuel cell comprising a plurality of individual fuel cells, with the fuel cell state variable comprising the voltage across just an individual fuel cell. Claims 20-24 detail aspects of the humidification scheme, pertinent to controlling water in the system, and nowhere disclosed in Meltser et al.

Corresponding amendments have been made to the method claims, 10-18. Thus, as detailed above, the feature of providing an additional amount of the second reactant to the fuel cell, when a flooding condition is detected, has been introduced from claim 11 into claim 10, with claim 11 now being cancelled.

In claim 12, this now recites the recirculation feature. New claims 25-31 have been introduced generally corresponding to the new system claims 20-24.

Excess Claim Fees

As the total claim count is now 29, fees for nine extra claims are being paid as indicated on the fee transmittal form.

Accordingly, as amended, the claims are in order for allowance, and early review and allowance are requested.

Respectfully submitted,

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